8-2001

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July 2000

Abstract

This paper determines the effects of household demographic composition and food aid on child farm labor supply controlling for household fixed effects. The results indicate that a child has a higher probability of working on farm if he or she is living with younger children, suggesting that older children are reducing resource constraints. The results on food aid indicate that receiving free distribution has *relatively* larger positive effects on the probability of girls working on farm than boys, while participating in food for work has *relatively* larger negative effects.

JEL classification codes: O12, J13, J22, F35
Key Words: Child Labor, Food Aid, Demographic Composition, Ethiopia

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I gratefully acknowledges funding for this study from the Food Security and Productivity Unit of the Productive Sectors Growth and Environment Division, Office of Sustainable Development, Bureau for Africa, USAID (AFR/SD/PSGE/FSP). My contribution to the study was conducted under the Food Security II Cooperative Agreement between AID/Global Bureau, Office of Agriculture and Food Security, and the Department of Agricultural Economics at Michigan State University. Support for the collection and initial analysis of data is acknowledged from USAID/Ethiopia. I appreciate detailed and helpful comments from Thomas Jayne and John Strauss. I also acknowledge very beneficial interactions with Alemu Asfaw, Nazmul Chaudhury, Daniel Clay, Kei Kajisa, Melody McNeil, Daniel Molla, Janet Owens, and Mike Weber. I take full responsibility for the findings and implications of the study.

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1. Introduction

Although there is an increasing number of empirical studies on child labor (Akabayashi and Psacharopoulos, 1999; Basu, 1999; Grootaert and Patrios, 1999), many empirical studies come from South Asia, where farm labor markets are active, and show that children are economically active and responsive to wage rates (Rosenzweig and Evenson, 1977; Cain, 1977; Skoufias, 1993; Jacoby and Skoufias, 1997). In rural Ethiopia, farm labor markets are not as active as in South Asia and children work on farms as unpaid family workers with very few hired workers. Under such conditions, the household demographic composition becomes an important factor in child farm labor supply. Yet, the direction of effects of an additional child in the same household on other children's labor supply is not clear. An additional child may reduce other children's work share, but the additional expenditure and child care requirements may increase other children's working time (Parish and Willis, 1993; Garg and Morduch, 1998; Behrman, 1997).

Different types of food aid in rural Ethiopia provide an opportunity to examine how various policies influence child farm labor supply. Food aid was thought to discourage farm labor supply on farm production by providing food directly to households and by providing employment opportunities outside farm production (Webb, von Braun, and Yohannes, 1992; Maxwell, Belshaw, and Lirenso, 1994; Datt and Ravallion, 1994). On the other hand, food aid may increase the effective labor supply of recipients by increasing their health status. When food aid is provided to the neediest households or the neediest individuals within the households, the positive effects of food aid on labor supply may exceed the disincentive effects. The sizes of both the disincentive and positive effects of food aid may differ between girls and boys, or young and old. Recent reviews of intrahousehold resource allocation studies call attention to how resources are allocated within the household (Haddad, Hoddinott, and Alderman, 1997; Strauss and Beegle, 1996).

One difficult issue in estimating the effects of an additional child and food aid reception is the endogeneity of the household composition and food aid reception. Children in Sub-Saharan Africa live under various living arrangements (Lloyd and Desai, 1992). The household composition can be endogenous in child farm labor supply because households may control their household composition through fertility (Schultz, 1997), fostering (Ainsworth, 1996), adoption, marriage (Parish and Willils, 1993), migration, or other arrangements to fulfill their labor demand. Food aid can be endogenous because it is often targeted to poor households. In this paper, we try to reduce the endogeneity problem by estimating household fixed effect models; although, by estimating household fixed effects, we can only estimate the *differential* effects of food aid between genders and age groups in the same household, not the level effects of food aid.

The purpose of this paper, therefore, is to determine the effect of household composition and the differential effect of food aid on child farm labor supply. First, we estimate the "reduced form" farm child labor supply with ordered logits. Children aged 7 to 14[1] are stratified into four

[1] We include all children aged between 7 and 14 in our sample, instead of restricting the

groups: boys aged 7 to 10, girls aged 7 to 10, boys aged 11 to 14, and girls aged 11 to 14. Second, we compare the effects of household composition with and without controlling for household fixed effects. We compare them because the estimated coefficients of household composition without controlling for household fixed effects might be biased if the household composition is correlated with unobservable household characteristics. Third, we estimate the *differential* effects of food aid on child farm labor supply between genders and age groups in the same household.

The results from the reduced form child farm labor supply with household fixed effects indicate that a child, especially a boy, has a higher probability of working on farm if he or she is living with younger children.[2] The results also indicate that food aid has significantly different effects between boys and girls. Free distribution has *relatively* larger positive effects on the probability of girls working on farm than boys, while participating in food for work has *relatively* larger negative effects.

The paper is organized as follows: Section 2 describes the data we use and gives a brief description of farm labor supply and food aid distributions in rural Ethiopia. Section 3 provides theoretical models and empirical specification. The results and interpretations are discussed in Section 4, followed by Section 5 with conclusions.

2. Data

The data come from the 1996 Food Security Survey (FSS), fielded on a subset of Agricultural Sample Survey (ASS) sample households in 1996 by the Central Statistics Authorities (CSA) and the Grain Marketing Research Project in Ethiopia. In the ASS sample, 25 households were randomly selected in each Enumeration Area (EA); there were 612 EAs in the sample. Out of the 25 sampled households in each EA, 12 households were selected to be in the Economic and Social Welfare Monitoring Survey (ESWMS) funded by the World Bank. The ESWMS asked distances to various facilities such as primary schools, health centers, and water sources. Out of the 12 households in each EA, 7 households were selected to be in the Food

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sample to household heads' biological children. About 15 percent of all children are step children (almost all of them are heads' biological children with step mothers), and another 15 percent are not children of the heads but younger brothers or sisters of heads, relatives, or non-relatives. Because we include all of them in our analysis, we avoid using *siblings* to indicate children living in the same household.

[2] "Older" and "younger" are based on relationships between a child and other children living in the same household.

Security Survey (FSS), leaving 3,823 households. In addition, monthly rainfall data from 40 rainfall stations distributed throughout Ethiopia were matched to the locations of the household samples.

The FSS asked each household member's farm labor participation in own farm production in three categories: working full time, half time, and no/little time. At age 7, already more than 30 percent of boys and about 25 percent of girls work more than half time on farm. The probability of working rapidly increases during early ages. By age 14, more than 75 percent of boys and about 60 percent of girls work more than half time on farm.

Farm labor markets are not active in rural Ethiopia. In Table 1, we present percentages of sampled households who hired agricultural labor during the major cropping season (Meher) in 1996. Only 10 percent of households hired agricultural labor. (The percentage of households who worked as hired agricultural labor should be higher than 10 percent. Unfortunately we do not have information on working as hired agricultural labor.) The percentages of hired agricultural labor use are relatively lower in the major food aid reception regions, namely Tigray and Amhara, than other regions. Although this information is very limited, it is a solid indication of thin farm labor markets in rural Ethiopia

Food aid in Ethiopia has historically taken two major forms (Webb, von Braun, and Yohannes, 1992; Sharp, 1997): free distribution (FD) and food for work (FFW). FD programs distribute cereals (wheat, maize, and sorghum) and cooking oil directly to households. Although local level distribution criteria vary from one wereda[3] to another (Sharp 1997), some level of targeting to low income households is achieved (Jayne et al., 2000). Most FFW activities are categorized as "development" food aid programs since they focus on developing assets such as roads, terraces, and dams. In theory, FFW is supposed to attract workers from low income households through self-selection (Besley and Kanbur, 1993). But in practice, payments from FFW were often set above local wage rates, attracting participants from all income levels (Sharp, 1997). Nonetheless, Jayne et al.(2000) found a negative association between FFW participation and per capita pre-aid income; although, the association was smaller and weaker than the one found in FD programs.

Receipt of food aid is measured for each household in the Food Security Survey. For the last 12 months, the respondent is asked whether at least one member of the household participated in a food aid program. If yes, the type of program (as reported by the household) is recorded, separating FD from FFW, and by type of commodity received. If food aid was received, the quantities received were recorded for each month from June 1995 through May 1996. Unfortunately, we do not know which member of a given household participated in FFW. This is a serious data limitation for us because participating in FFW may reduce participants' working time on farm significantly but may increase nonparticipants' working time to substitute in for participants.

[3] Wereda is a small regional unit, which is akin to county in the United State. There are about 450 weredas in rural Ethiopia and 348 weredas in our sample.

In Figure 1,[4] separately for males and females, we stratified our sample into three groups: children without any food aid, children with FD, and children with FFW.[5] The figures represent bivariate relationships between the probability of working on farm by age for three groups. As one can see in the left panel of Figure 1, we do not see much difference in the probability of working on farm between these three groups of boys. But for girls, the differences are more obvious. Girls with FD have a higher probability of working on farm than girls without any food aid. Girls with FFW have much different age profile. Girls with FFW have a lower probability of working on farm than girls without any food aid if they are older than twelve. One possibility, out of many others, is that girls aged above 12 participate in FFW by reducing their working time on farm. However, because we do not have individual level information of FFW participation, we are unable to investigate it further.

3. The Effects of Food Aid

3.1. Theoretical Models

Household utility is a function of total household consumption (C), adults' leisure (l_a), and children's leisure (l_c): U(C, l_a, l_c : □) , where □ is household characteristics, including household composition. The budget constraint is

$$C = F(L^F_a+L^H_a, L^F_c+L^H_c ; A) - w_aL^H_a - w_cL^H_c + w_aL^O_a + w_cL^O_c + Z \qquad (1)$$

$$L^T_a = L^F_a + L^O_a + l_a \qquad \text{for adults}$$

$$L^T_c = L^F_c + L^O_c + l_c \qquad \text{for children}$$

F(.) is the strictly concave farm production function; L^F_a and L^F_c are adults' and children's labor time spent in farm production, respectively; A is exogenous farm production characteristics; L^H_a

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[4] Figure 1 is created using locally weighted smoothed scatter plot (LOWESS) with window length set at .6 or .7 of the neighboring observations. The smoothed values are obtained by running a regression of y-variable on x-variable using weighted data so that the central point gets the highest weight and points farther away receive less weights. The estimated regression is then used to predict the smoothed value for y-variable. The procedure is repeated to obtain the remaining smoothed values, which means a separate weighted regression is estimated for every point in the data. We truncated the graph at the top 5 percent of age because the shape of the line is sensitive to the small number of observations.

[5] We do not include children with both FD and FFW in Figure 1.

and L^H_c are hired adult and child labor; L^O_a and L^O_c are adults' and children's off- farm labor time; w_a and w_c are wage rates for adult and child labor; Z is non-labor income; and L^T_a and L^T_c are adults' and children's total labor time.

In the following analysis we focus our attention on child *farm* labor supply under various situations. We present main results in Table 2. The effect of free distribution (FD) is considered as an increase in non-labor income (the income effect) while the effect of food for work (FFW) is considered as an increase in adult labor's wage (the substitution effect) because adults participate in FFW in most cases. Because child labor markets are often absent in rural Ethiopia, we also consider a situation in which children do not have access to labor markets (a non-separable case).

If the model is separable between production and consumption decisions, the *total* child labor supply (L_c) is a function of wages and full income (M): $L_c = L^T_c - l(w_a, w_c, M; □)$. However, the child *farm* labor supply depends on different factors conditional on whether a household is a net child labor seller or buyer. If a household is a net child labor seller ($L^O_c>0$), then the child farm labor supply is determined at where the marginal product of child labor is equal to the child wage rate. Therefore the child farm labor supply is $L^F_c = L^F_c(w_a, w_c, A)$, which is not a function of the full income or household composition. The impact of an increase in the child wage rate is negative, but the impact of the adult wage rate is positive under assumptions of $F□_{LcLa}<0$ and $F□_{LaLc}<0$.[6] On the other hand, if a household is a net child labor buyer, then the child farm labor supply is determined at where the marginal rate of substitution between consumption and child leisure is equal to the child wage rate; $L^F_c = L^F_c(w_a, w_c, M; □)$. The impact of an increase in the full income is negative.

The effects of household composition and of food aid when a household is a net child labor seller are different from the effects when a household is a net child labor buyer. Household composition and free distribution (FD) have *no effects* on child farm labor supply when a household is a net child labor seller (even though they have impacts on the total child labor supply). When a household is net child labor buyer, FD has negative impacts on the child farm labor supply, while household composition can have impacts in either direction. FFW (increases in adult labor wage rates) increases the full income, so it has negative income effects when a household is a net child labor buyer, but has no income effects on child farm labor supply when a household is net child labor seller. However, increases in adult wages do have substitution effects on child labor demand; adult labor becomes more expensive so the demand for child labor on farm increases. As a result, FFW has positive effects on child farm labor supply of net child labor sellers but a mix of positive and negative effects on child farm labor supply of net child labor buyers.

When child labor markets do not exist (a non-separable case), the child farm labor supply

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[6] From profit maximization with respect to two labor inputs, we have $F'_{La}(L_a, L_c)= w_a$ and $F'_{Lc}(L_a, L_c) = w_c$. The total differentiation and some arrangements give us: $dLc/ dw_a = 1/(F''_{LaLa}F''_{LcLc} - F''_{LaLc}F''_{LcLa})(-F''_{LcLa}) >0$.

is a function of the adult wage rates, shadow wages for child farm labor, and household characteristics: $L^F_c(w_a, w_c^*, A)$. An increase in non-labor income increases the child shadow wage and has negative effects on child farm labor supply. An increase in the adult wage rate increases the shadow wage of child farm labor but also increases the demand for child farm labor. Therefore the direction of FFW's effects is ambiguous. Based on these results (Table 2), we will examine the differential effects of FD and FFW. We present our estimation strategies in the next sub-section.

3.2. Empirical Specification

As mentioned previously, we do not observe farm labor time allocation in our survey data. Rather we observe categorical information: full time, half time, and no/little time working on farm production. We define the dependent variable, y_{ji}, equal to 2 if the individual i works full time, 1 if half time, and 0 if no/little time. The linearized version of the reduced form farm labor supply using a categorical dependent variable can be written as:

$$y_{ij} = \begin{cases} 0 & \text{if} \quad z_1 > y^*_{ij} \\ 1 & \text{if} \quad z_2 > y^*_{ij} > z_1 \\ 2 & \text{if} \quad y^*_{ij} > z_2 \end{cases} \tag{2}$$

where $y^*_{ij} = \square_x\square\, x_{ij} + \square_h\square\, h_j + e_{ij}$.

y_{ij} is individual i's farm labor supply in household j; y^*_{ij} is the latent variable of y_{ij}; x_{ij} is individual characteristics; and h_j is household characteristics; z_1 and z_2 are cut-points to be estimated; and $\square_x\square$ and $\square_h\square$ are coefficients. We estimate the reduced form child farm labor supply equations with ordered logits.

Next, we estimate the differential effects of food aid using the conditional logits models, developed by Chamberlain (1980).[7] Let us illustrate the conditional logits with two individuals in the same household, and then demonstrate how this model can be applied in our models. Let the logits model be:

$$\mathrm{Prob}(y_{ij} = 0 \mid x_i, \square_j) = 1 / (1 + \exp(\square\square_x x_i + \square_j)) \quad \text{for } i = 1, 2 \tag{3}$$

$$\mathrm{Prob}(y_{ij} = 1 \mid x_i, \square_j) = \exp(\square\square_x x_i + \square_j) / (1 + \exp(\square\square_x x_i + \square_j)) \quad \text{for } i = 1, 2 \tag{4}$$

where $\square_j$ is the household characteristics. The only relevant case is when $\square_i = y_{1j} + y_{2j} = 1$. Therefore the conditional probability, conditioning on $\square_i = 1$, is

$$\begin{aligned} \mathrm{Prob}[(1,0)|(1,0) \text{ or } (0,1)] &= \mathrm{Prob}(1,0) / [\mathrm{Prob}(1,0)+\mathrm{Prob}(0,1)] \\ &= \exp(\square\square_x x_1 + \square_j) / [\exp(\square\square_x x_1 + \square_j) + \exp(\square\square_x x_2 + \square_j)] \\ &= 1 / [1 + \exp(\square\square_x (x_2 - x_1)] \end{aligned} \tag{5}$$

As one can see, the household characteristics, $\square_j$, has been conditioned out in the last equation.

Now, let us consider the problem with an example of a two-person household with one boy and one girl. First, we redefine our dependent variable as a dummy variable. We redefine y_{ij} equal to one if the individual i works more than half time and zero otherwise:

[7] The discussion in this sub-section follows Pitt (1997).

$$y_{ij} = \begin{cases} 0 & \text{if} \quad z_1 > y^*_{ij} \\ 1 & \text{if} \quad y^*_{ij} > z_1 \end{cases} \qquad \text{for } i = \underline{b}\text{oy or } \underline{g}\text{irl} \qquad (6)$$

$$y^*_{ij} = (\square_z + \square_z d_i)\square q_j + (\square_x + \square_x d_i)\square\, x_{ij} + (\square_h + \square_h d_i)\square\, h_j + \square_j + u_{ij},$$

where q_j is the per capita value of food aid received at the household level; d_i is the gender dummy variable which is one if individual i is a girl; h_j is the observable household characteristics; $\square$'s are the coefficients of the interaction terms with gender dummies; the error term e_{ij} is decomposed into two components: $\square_j$ is a household specific component (unobservable household characteristics) and u_{ij} is an individual specific component; and other variables are defined as in (2).

Because food aid is not distributed randomly, the per capita value of food aid received, q_j, is more likely to be endogenous or to be correlated with the unobservable household characteristics, $\square_j$. As a result, estimated coefficients of q_j may be biased. Moreover, some of the other variables, such as household composition, might be correlated with $\square_j$. By taking the difference between the farm labor supply of a boy and a girl in household j, we have

$$y^*_{bj} - y^*_{gj} = \square_z d_b \square q_j + \square_x \square (x_{bj} - x_{gj}) + \square_x d_b \square x_{bj} + \square_h d_b \square\, h_j + (u_{bj} - u_{gj}). \qquad (7)$$

The unobserved household characteristics are eliminated, and q_j is no longer correlated with the error term, provided that $\square_j$ was the only source of the correlation. However, we are no longer able to estimate $\square_z$ and $\square_h$. We can estimate this equation (7) with conditional logits: the right hand side of equation (7), except the error terms, is the $\square\square_x (x_2 - x_1)$ in equation (5).

If food aid, q_j, is correlated with the unobservable household characteristics, $\square_j$, but not with the error terms in conditional logits, then estimated $\square_z$ are consistent. However, if food aid, q_j, is correlated with the error terms of the conditional logits, i.e., $\text{cov}(q_j, u_{bj} - u_{gj})\square 0$, then the estimated $\square_z$ will be biased. A possible candidate for an important unobservable individual characteristic is child health status. It is reported that child health status was used often as a targeting measure in free distribution (Sharp 1997). To avoid this potential omitted variable problem, it is possible to use an instrumental variables by using restrictions that set some of $\square_h$'s equal to zero to obtain instruments, following Pitt and Rosenzweig (1990). But because such restrictions require a very strong assumption, we do not take this approach, leaving the possible biases in equation (7) unexamined.

3.3. Variable Construction

The food aid variables are constructed as the per capita value received by each household. Because food aid is paid in kind (wheat, maize, sorghum, and cooking oil), regional level prices were used to convert kilograms-received into value-received in birr.

Unfortunately, we do not have much individual information, only age and the relationship with household heads.[8] We use this information to measure children's status in their household and categorize each child into three groups. The first group is children whose biological parents are the head of the household and his wife. The second group is children who have a step-father

[8] Entire categories are head, wife/husband, head & wife's child, head's child (but not wife's), wife's child (but not head's), head's or wife's father or mother, head's or wife's sister or brother, others, and no relation.

or a step-mother. A child in this group is called a *step child*. Almost all step children are children of household heads. The last group includes children who are either brothers or sisters of the head, other relatives, or non-relatives. A child in this group is called a *relative child* even though this group includes non-relative children. A household with higher labor demand may have incentives to adopt or foster children to fulfill its labor demand. If the household labor demand is a major reason for keeping *relative children*, then we may find *relative children* working more than other children. In the estimation, we use two dummy variables for the last two groups: *step child* and *relative child*.

We include six variables on child composition; four of them are *child specific*, which means that each child within a household has distinct values. The four variables are the number of younger boys, younger girls, older boys, and older girls aged 7 to 14. Younger and older are defined based on a child in question. For example, for a 7 year-old boy who has a 10 year-old sister, the number of older sisters is one, and for the sister the number of younger boys is one. Therefore they have different values in two variables even though they belong to the same household.

The other two child composition variables are the numbers of boys and girls under age 6. For children aged 7 to 14 who belong to the same household, the number of boys and girls under age 6 are the same. Thus, these two variables are *household specific* variables. This distinction is important when we estimate conditional logits, because we can estimate level effects of child specific variables, while of household specific variables we can not. We also include four other demographic composition variables: the numbers of male and female adults aged 15 to 49, and male and female elderly age over 50. Again for children aged 7 to 14, these variables are household specific.

The only information available on education is of the household heads'.[9] Since most of household heads do not have education, we use a dummy variable which is one if a household head has any education. We also include two dummy variables for female headed households: one for a female head who is currently unmarried and one for currently married female heads. We have three variables that represent household wealth: the amount of land owned in hectares, the value of large animals owned in birr, and the value of chicken owned in birr. Large animals and chickens are separated, because large animals are likely to be herded by children. The predominant religion in Ethiopia is Orthodox Christianity, but there are a substantial number of Muslim and Protestant households as well. Therefore, we use two dummy variables: one for Muslim households and one for Protestant households. Other religions such as local or traditional religions are omitted with Orthodox Church. The last household characteristic variable included is a dummy variable for households engaging exclusively in livestock production (herders) because their production system is significantly different from farm production systems.

We have wereda average distances to the nearest primary school which comes from the Social Welfare Monitoring Survey. Because the survey covers the same weredas in the FSS

[9] Therefore we can not test whether husband's and wife's education have different effects child labor supply, as in many intra-household studies. See Strauss and Beegle (1996) for survey.

survey, we were able to match the wereda average distance to the nearest primary school to the FSS sample households at wereda level. From the Social Monitoring Survey we have similar information on distances to the nearest health center and water source, which we also include.

Regarding agro-climate variables, we use elevation (in meters) and long-run rainfall during a growing season. Elevation readings were taken using the Global Positioning System, a satellite-based system designed to take such readings. Rainfall is a critical factor related to cereal production in Ethiopia because farming is rainfed (not irrigated). We use median Meher season planting rainfall (in millimeters) from 1988 through 1995.[10] These were derived by summing April through August rainfalls for these years from data collected by 40 rainfall stations of the Ethiopian National Meteorological Services Agency. Each sample zone (an area whose size is in between a wereda and a killil) was matched up to the closest rainfall station, providing there was at least one in the area.[11] The other variables we have on community level infrastructure are on the type of roads. We use five dummy variables, road type 1 being the best conditioned road, followed by type 2, 3 and so forth.

4. Results

First, we present results from the “reduced form” child farm labor supply models with ordered logits. These will omit any food aid effects, but include household composition. Second, we compare coefficients of child composition from logits and conditional logits. Finally, we present results on the differential effects of food aid between boys and girls, boys and female adults, and girls and female adults.

4.1. Results on Reduced Forms

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[10] These years were chosen because earlier years had many missing observations for many stations.

[11] As mentioned, the Afar area was the one that did not have a rainfall station close by (and the nearest did not have 1995 data). We consequently dropped that area, which only contains 86 households. All weredas within a zone were assigned the same long-run median rainfall.

The results presented in column 2 of Table 3 indicate that an additional older boy or girl decreases the probability of boys in the younger age category (aged 7 to 10) working on farm; the magnitude is larger for an older boy than girl. To capture meaningful interpretations, we conduct some simulations on having various numbers of older boys and girls in the same household.[12] According to these simulations, the probability of boys in the younger age category working full time on farm decreases by 7.0 percent from 30.7 percent as the number of older boys in the same household increases from zero to one and by 6.4 percent from 30.1 percent as the number of older girls increases from zero to one.

For girls in the younger age category we have similar results: an additional older boy in the same household decreases the probability of working full time on farm (column 2 of Table 4). According to simulation results, the probability of girls in the younger age category working full time decreases by 5.3 percent from 20.9 percent as the number of older boys increases from zero to one. On the other hand, an additional older girl does not have significant effects. These results suggest that older boys are more productive in farm production than girls in the younger age category, but older girls may not be more productive or they have higher opportunity costs, probably in home production.

The primary working place of girls is in home production. One can see the evidence of this in coefficients of the number of boys aged less than 6 in column 4 of Table 4. These coefficients indicate that an additional boy age under 6 significantly reduces the probability of girls in the older age category working on farm. The results are consistent with the idea that these girls are taking care of boys age under 6. Interestingly, an additional girl age under 6 does not have significant effects on girls' probability of working on farm.

An interesting finding in Table 4 is that the estimated coefficients of female adults aged 15 to 49 and elderly age over 50 are *positive* on the probability of girls working on farm, indicating that an additional female adult *increases* the probability of girls working on farm. The opposite is true: an additional girl in the older age category increases the probability of female adults working on farm (column 2 in Table 5). One interpretation is that an additional female adult (already engaging in home production) reduces girls' comparable labor productivity in home production where labor inputs may have rapid diminishing return. Thus, an additional female adult in the household may push a girl into farm production.

It is considered that there is a trade-off between schooling and working for children (e.g., Rosenzweig and Evenson, 1977). To find this trade-off, previous empirical studies used some proxies of schooling costs, such as availability of schools (Rosenzweig, 1981), the distance to the nearest school (Grootaert, 1999), or average out-of-pocket expenditures on schooling

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[12] To carry out these simulations, we set the number of older boys in the household at 0 after we estimate the model, then we predict the probability of working for all younger boys and take the average. Next, we set the number of older boys at 1, and predict the probability and take the average. We repeat this for the number of older boys equal to 2.

(Cartwright, 1999). Using these proxies raises concerns on the endogenous school placement, omitted variable problems, and endogeneity of average school expenditure. Despite its problems, we use the wereda level average distance to the nearest primary school as a proxy of schooling costs, because no better proxy for schooling costs is available.

In fact, the results from female adults' reduced form farm labor supply suggest a major problem in interpreting estimated coefficients. As one can see in Table 5, the estimated coefficient of the distance to the nearest primary school is positive and significant for the probability of female adults, who are not in schools, working on farm. The distance to the nearest primary school may be picking up other regional factors. From this result, we expect to find similar results that children who live in areas farther away from primary schools have higher probabilities of working on farm even without the trade-off between schooling and working on farm. Thus, we need to be cautious when we interpret the results.

The estimated coefficients of the distance to the nearest primary school are positive and significant (except for girls in the older age category) as expected. According to our simulation results, the probability of boys in the younger age category working full time will decrease by 3.4 percent from 30.8 percent if the distance to the nearest primary school is shortened from the 75th to 25th percentile by 5.1 km. The probability of boys in the older age category working full time on farm will decrease by 3.6 percent from 51.9 percent. The probabilities of girls in the younger and older age categories will decrease by 3.0 percent from 16.3 percent and by 0.6 percent from 27.0 percent, respectively. Because of possible overestimations, we should suspect that the real effects of changing the distance to primary schools on child farm labor supply are smaller than these results.

These results suggest one important policy implication: providing schools is not enough to considerably reduce child farm labor supply. In our data, about 38 percent of boys and 20 percent of girls work full time on farm. Less than 4 percent or possibly smaller changes in probabilities of working full time on farm, by reducing the distance to primary schools by 5 km, seem too insignificant against the high percentages of children working full time. These results seem to suggest that the absence of schools is not the major determinant of child farm labor supply, but the absence of farm labor is a major determinant of child labor supply in rural Ethiopia. One possible approach is to make schooling more attractive by providing targeted enrollment subsidies (Grootaert and Patrinos, 1999). However, as Ravallion and Wodon (1999) show, subsidies may not reduce child farm labor significantly either.

The education of household heads reduces the probabilities of children working on farm; the effects are larger for boys and girls in the older age category. For boys, the simulation results indicate that the probability of boys in the younger age category working full time on farm decreases by 3.7 percent from 28.1 percent if their household heads have some education, and for boys in the older age catagory, their probability decreases by 13.7 percent from 46.8 percent. For girls, the probability of girls in the younger age category working full time on farm decreases by 3.1 percent from 18.9 percent, and for girls in the older age category the probability decreases by 6.2 percent from 26.2 percent. The negative effects of household heads' education are consistent with findings from other empirical studies on child labor supply (Grootaert and Patrions, 1999).

One might think that boys work more in female headed households because male adults are not available. The results indicate the opposite, boys work less on farm in female headed households than boys in male headed households. The negative coefficients of female headed households suggest two possibilities. First, female heads choose activities that do not require male labor, such as non-farm activities. Second, female heads value boys' non-working time more than male heads do. It is not clear which case is more plausible in rural Ethiopia.

In various developing countries, children take care of domestic animals (Bonnet, 1993). The results imply that this is also the case in rural Ethiopia. The estimated coefficients of big animals are significantly positive for boys, especially for boys in the older age category (Table 3) and for girls in the younger age category (Table 4).

Girls in the older age category who are *relatives* (either sister, relative, or no relative) to their household heads have a lower probability of working on farm; the estimated coefficient is significant at 10 percent with wereda fixed effects. No significant effects were found on boys who are *relatives*.

Regional characteristics have significant effects on boys' probability of working on farm but not for girls. Boys work more in areas with higher average rainfall and in higher elevation (Table 2). Higher rainfall may indicate higher agricultural labor demand in the areas, while higher elevation may indicate less active farm labor markets. Combined, these results suggest that boys work more where farm labor demand on farm production is high and farm labor markets are less active.

4.2. Results on Reduced Forms with Household Fixed Effects

To estimate conditional logits, we exclude children who live in households with only one child or no variation in the dependent variable among children, leaving 1,561 children in 577 households. We estimate logits and conditional logits by using the same sample so that we can compare the estimated coefficients. If estimated coefficients from logits are consistent, then estimated coefficients from conditional logits are consistent but less efficient. The Hausman test can be used to test whether there is a statistically significant difference between the estimated coefficients from logits and conditional logits (Greene, 2000: pp841). Because we are unable to estimate coefficients of variables that are common to all households members in conditional logits, the only variables that we can compare are variables that vary across individuals; in this case, *child* specific variables (i.e., individual characteristics and child composition) and variables interacted with a gender dummy. We are especially interested in changes in estimated coefficients of child composition and food aid that we suspect may be endogenous.

The results in Table 6 indicate that the estimated coefficients on child composition with logits in column 1 are statistically different from the ones with conditional logits in column 2; the Hausman test statistic is 18.0 (k=4) which is sufficiently large to reject the null hypothesis at 1 percent level. Especially, the estimated coefficients on number of younger and older boys increase when we control for households fixed effects. The estimated coefficient on number of younger boys nearly doubles from 1.079 in column 1 to 1.975 in column 2 of Table 6, and the estimated coefficient on number of older boys changes from -1.039 in column 1 to 0.487 in column 2. The estimated coefficients on number of younger and older girls do not change much, the standard errors get larger, but this is what we expect in conditional logits. One possible explanation for the changes in boys' coefficients is that the gender and age composition is endogenous in the child labor supply equation; the number of younger and older boys are correlated with unobserved household characteristics that are associated with probability that children work on farm.

4.3. Results on Differential Effects

The results in column 3 of Table 6 (logits) indicate that receiving food aid through FD does not have significant effects on the probability of boys working on farm but it has significantly larger positive effects on the probability of girls. In contrast, participating in FFW has positive effects on the probability of boys working on farm but it has significantly smaller effects on the probability of girls. However, as discussed in Section 3.2, these estimated coefficients might be biased because of unobservable household characteristics. Thus, we present the results from conditional logits in column 4. Because per capita values received from FD and FFW are common to all households members, we are unable to estimate their coefficients.

The estimated coefficients of interaction terms with gender dummy (1 for girls) change downward.[13] Because we are unable to estimate the level effects of FD and FFW, we can interpret the results in two ways: receiving food aid from FD either (i) decreases the probabilities of boys and girls working on farm with smaller negative effects on girls, or (ii) increases the probabilities of boys and girls working on farm with larger positive effects on girls. Although, the second interpretation is consistent with the results with logits in column 3 (and with Figure 1 to some extent), we are unable to choose the second interpretation because the estimated coefficient of FD with logits might be biased in either way.

The negative coefficient on per capita value received from FFW interacted with the gender dummy can be interpreted in two ways also: participating in FFW either (i) increases the probabilities of boys and girls working on farm with smaller positive effects on girls, or (ii) decreases the probabilities of boys and girls working on farm with larger negative effects on girls. The logit results in column 3 are consistent with the first interpretation. Again we are unable to choose one out of these two interpretations. Yet, because the estimated coefficient of per capita value received from FFW is positive and significant at the 10 percent level in column 3, the first interpretation might be a better interpretation. This interpretation suggests that boys are substituting in farm production when their households participate in FFW, or girls are working off-farm, possibly working more in home production or participating in FFW themselves, when their households participate in FFW.

The differential effects of food aid between boys and female adults in Table 7 are similar to those between boys and girls. The signs of estimated coefficients of interaction terms with the girl dummy in column 3 and 4 of Table 6 are the same as the ones with the female adult dummy in column 1 and 2 of Table 7; although, magnitudes are smaller with the female adult dummy. Again, we have two interpretations on the coefficients of interaction terms and are unable to select one definitively. However, the results demonstrated a similar pattern between boys and girls and between boys and female adults.

[13] The Hausman statistics on these two interaction terms was negative, which is possible when we compare coefficients between logits and conditional logits.

The differential effects between girls and female adults in column 3 and 4 of Table 7 are presented along with other results. Receiving food aid from FD has a relatively larger positive effect on girls than female adults. From all of these results of receiving food aid from FD, we may conclude that receiving food aid from FD has relatively larger positive effects on girls than female adults, and relatively larger positive effects on female adults than boys. The size of estimated coefficient of interaction term comparing boys v.s. girls (0.024) is about the sum of sizes of estimated coefficients of interaction term comparing boys v.s. female adults (0.009) and girls v.s. female adults (0.017).

The FFW results presented in columns 3 and 4 of Table 7 indicate that there are no significant differential effects between girls and female adults. Based on these results and on ones presented above, we may conclude that participating in FFW has relatively larger positive effects on the probability of boys working on farm than girls and female adults, but has no significant differential effects between girls and female adults.

These results suggest that different types of income transfer programs will have different outcomes on boys' and girls' farm labor supply. Although it is difficult to investigate why FD and FFW have differential effects between genders and age groups without knowing the level effects of food aid, it is important to recognize such differences.

5. Conclusions

In this paper, we have considered the effects of household demographic composition and food aid on child farm labor supply. Because the demand for farm labor influences schooling in rural Ethiopia, improved understandings on the determinants of child farm labor supply will help governments to carry out various policies to increase school attendance effectively. To examine the determinants of child farm labor supply, we estimated the reduced form child farm labor supply with ordered logits. The results indicate that lack of farm labor is a major determinant in child farm labor supply. For instance, the presence of an additional male adult decreases the 3probabilities of children in the older age category (aged 11 to 14) working on farm. For girls, the presence of female adult is one of the major determinants. An additional female adult *increases* the probability of girls in the older age category working on farm. This result may suggest that girls in the older age category have lower comparative productivity in home production when more female adults are available in the households.

Household demographic compositions could be correlated with unobserved household characteristics in child farm labor supply models. The Hausman test indeed found a significant difference between the estimated coefficients of child composition with (conditional logits) and without (logits) controlling for household fixed effects. The results with conditional logits indicate that a child, especially a boy, has a higher probability of working on farm if he or she is living with younger children, suggesting that older children living with younger children reduce resource constraints by working on farm.

Different types of food aid programs have different effects, and even a food aid program has different effects between boys and girls. The results indicate that two types of food aid programs (free distribution and food for work) have opposite differential effects on child labor supply for boys and girls. More specifically, receiving free distribution has *relatively* larger positive effects on the probability of girls working on farm than boys, while participating in food for work has *relatively* larger negative effects. A direct income transfer program, such as free distribution, and an employment program, such as food for work, have different effects on boys' and girls' farm labor supply. These differences may result from households' reallocation of their adult and child labor when they participate in food for work programs.

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Table 1. Sampled Households, Food Aid, and Hired Agricultural Labor

Region	Number of Sampled Households	Households who hired agricultural labor [1]	Households Received Free Distribution (FD)	Households Received Food For Work (FFW)
	Number	— Percent of Households —		
Tigray	229	8	40	34
Amhara	1043	9	25	11
Oromiya	1343	12	5	7
South	973	8	8	7
Addis Ababa / Dire Dawa	125	24	6	32
Others	368	7	15	8
Total	4081	10	14	10

Note: 1) During Meher season in 1996.

Table 2. The Effects of Food Aid on Child *Farm* Labor Supply

	Separable		Non-Separable (No child labor market)
	Net Seller	Net Buyer	All
FD (_Z>0)	No Effects	Negative	Negative
FFW (_w_a>0)	Positive	Ambiguous	Ambiguous

Table 3. Reduced Form Farm Labor Supply for Boys Aged 7 to 14 (Ordered Logit)

	Boys aged 7 to 10		Boys aged 11 to 14	
		Wereda FE		Wereda FE
	(1)	(2)	(3)	(4)
Individual Characteristics				
Age	0.306	0.581	0.127	0.124
	(5.12)**	(6.91)**	(1.81)	(1.25)
Child w/step mom/dad (0,1)	0.025	0.191	0.279	0.173
	(0.13)	(0.70)	(1.33)	(0.61)
Child, relative (0,1)	-0.043	-0.380	0.336	0.277
	(0.18)	(1.05)	(1.41)	(0.84)
Child Composition				
Boys 0-6 (#)	0.156	0.110	-0.017	-0.035
	(2.06)*	(1.02)	(0.20)	(0.27)
Girls 0-6 (#)	0.002	0.090	-0.101	-0.078
	(0.03)	(0.84)	(1.13)	(0.65)
Younger boys (7-14)	0.133	0.060	0.054	0.197
	(0.84)	(0.29)	(0.58)	(1.55)
Younger girls (7-14)	0.086	-0.025	0.087	0.210
	(0.50)	(0.11)	(0.92)	(1.59)
Older boys (7-14)	-0.362	-0.515	-0.313	-0.267
	(4.00)**	(4.09)**	(1.53)	(1.00)
Older girls (7-14)	-0.384	-0.474	-0.156	-0.136
	(3.93)**	(3.46)**	(0.70)	(0.46)
Other Demographic Composition				
Male adults 15-49 (#)	-0.028	-0.089	-0.286	-0.303
	(0.36)	(0.85)	(3.83)**	(2.92)**
Female adults 15-49 (#)	0.074	0.025	-0.034	0.138
	(0.86)	(0.21)	(0.36)	(1.04)
Male Elderly 50- (#)	-0.041	-0.080	-0.030	-0.351
	(0.28)	(0.40)	(0.19)	(1.60)
Female Elderly 50- (#)	0.238	0.538	0.046	0.255
	(1.29)	(2.06)*	(0.25)	(0.96)
Household Characteristics				
Household head's education (0,1)	-0.242	-0.276	-0.420	-0.783
	(1.80)	(1.44)	(2.68)**	(3.54)**
Female headed household (0,1)	-0.025	-0.381	-0.820	-1.105
	(0.09)	(0.99)	(2.82)**	(2.69)**
Female headed, but married (0,1)	0.067	-0.216	-0.408	-0.769

	(0.20)	(0.47)	(1.37)	(1.76)
Land owned (ha)	0.008	0.028	-0.051	-0.061
	(0.59)	(1.71)	(2.03)*	(1.99)*
Value of big animals ('000birr)	0.032	0.023	0.016	0.106
	(1.38)	(0.63)	(0.57)	(2.47)*
Muslim (0,1)	-0.361	-0.267	0.088	0.155
	(1.93)	(0.75)	(0.43)	(0.40)
Protest (0,1)	-0.043	0.681	0.196	0.519
	(0.22)	(2.10)*	(0.89)	(1.36)
Regional Characteristics				
Distance to Primary School (km)	0.046		0.041	
	(2.47)*		(1.96)*	
Average Rainfall (mm)	0.001		0.002	
	(2.20)*		(3.04)**	
Elevation	-0.001		0.000	
	(4.17)**		(2.07)*	
	Domain Dummies	Wereda Dummies	Domain Dummies	Wereda Dummies
Observed % (Full, Half, No Time)	30, 27, 43	27, 28, 45	50, 35, 15	43, 38, 18
Wald tests: Child's relation with head	0.07 [0.97]	2.16 [0.34]	2.89 [0.24]	0.84 [0.66]
Siblings (7-14)	27.4 [0.00]**	24.7 [0.00]**	3.33 [0.50]	4.97 [0.29]
Demographic composition	6.12 [0.41]	5.82 [0.44]	16.7 [0.01]*	10.4 [0.11]
Road dummies	16.3 [0.01]**		11.2 [0.05]*	
Regional dummies	84.2 [0.00]**	273 [0.00]**	61.0 [0.00]**	188 [0.42]
Log Likelihood	-1207	-845.5	-945.9	-657.9
Observations	1251	1028	1046	793
	(0.81)	(0.26)	(0.50)	(0.13)

Note: Dependent Variable: Working time on farm {Full, Half, No time}. Absolute values of z-statistics are in parentheses. P-values are in brackets. * indicates significant at 5% level; ** indicates significant at 1% level. Other variables included are the value of chicken, a dummy for livestock households, rainfall shocks in 1994 and 1995, and road dummies.

Table 4. Reduced Form Farm Labor Supply of Girls aged 7 to 14 (Ordered Logit)

	Girls aged 7 to 10		Girls aged 11 to 14	
		Wereda FE		Wereda FE
	(1)	(2)	(3)	(4)
Individual Characteristics				
Age	0.415	0.680	0.029	0.156
	(5.95)**	(6.58)**	(0.39)	(1.36)
Child w/step mom/dad (0,1)	0.027	-0.028	-0.053	-0.155
	(0.12)	(0.10)	(0.25)	(0.44)
Child, relative (0,1)	0.032	0.008	-0.140	-0.783
	(0.12)	(0.02)	(0.59)	(1.93)
Child Composition				
Boys 0-6 (#)	-0.043	-0.083	-0.218	-0.323
	(0.52)	(0.68)	(2.37)*	(2.15)*
Girls 0-6 (#)	0.056	0.019	-0.133	-0.109
	(0.63)	(0.16)	(1.26)	(0.68)
Younger boys (7-14)	-0.076	-0.111	0.101	0.166
	(0.40)	(0.43)	(0.96)	(0.95)
Younger girls (7-14)	-0.213	-0.035	0.105	-0.148
	(1.10)	(0.13)	(0.95)	(0.86)
Older boys (7-14)	-0.324	-0.505	-0.569	-0.946
	(3.25)**	(3.52)**	(2.66)**	(2.68)**
Older girls (7-14)	-0.342	-0.187	-0.404	-0.794
	(3.01)**	(1.19)	(1.58)	(1.99)*
Other Demographic Composition				
Male adults (#)	-0.056	-0.106	-0.111	-0.348
	(0.71)	(0.92)	(1.42)	(2.87)**
Female adults (#)	0.096	0.235	0.070	0.322
	(0.99)	(1.74)	(0.78)	(2.12)*
Elders, male>=50 (#)	0.109	-0.192	-0.404	-0.244
	(0.68)	(0.86)	(2.34)*	(0.89)
Elders, female>=50 (#)	0.050	0.132	0.137	0.462
	(0.27)	(0.44)	(0.73)	(1.53)
Household Characteristics				
Household head's education (0,1)	0.005	-0.308	-0.519	-0.519
	(0.04)	(1.33)	(3.05)**	(1.91)
Female headed household	-0.081	0.044	-0.325	0.134

(0,1)				
	(0.27)	(0.11)	(1.13)	(0.30)
Female headed, but married (0,1)	0.499	0.681	-0.456	-0.711
	(1.49)	(1.45)	(1.17)	(0.98)
Land owned (ha)	-0.015	-0.006	-0.011	-0.019
	(1.20)	(0.38)	(0.84)	(1.27)
Value of big animals (‘000birr)	0.056	0.111	-0.015	0.034
	(1.82)	(2.27)*	(0.48)	(0.63)
Muslim (0,1)	-0.159	0.081	-0.197	0.083
	(0.75)	(0.18)	(0.84)	(0.16)
Protest (0,1)	-0.053	-0.179	0.224	0.606
	(0.23)	(0.45)	(0.85)	(1.36)
Regional Characteristics				
Distance to Primary School (km)	0.064		0.009	
	(3.26)**		(0.47)	
Average Rainfall (mm)	0.000		0.000	
	(0.21)		(0.00)	
Elevation	-0.001		-0.001	
	(3.04)**		(2.71)**	
	Domain Dummies	Wereda Dummies	Domain Dummies	Wereda Dummies
Observed % (Full, Half, No Time)	16, 27, 58	18, 29, 53	27, 38, 35	24, 39, 36
Wald tests: Child’s relation with head	0.02 [0.99]	0.01 [0.99]	0.35 [0.84]	3.82 [0.15]
Siblings (7-14)	17.7 [0.00]**	13.0 [0.01]*	9.87 [0.04]*	12.2 [0.02]
Demographic composition	3.37 [0.76]	4.33 [0.63]	10.8 [0.09]	17.4 [0.01]**
Road dummies	20.2 [0.00]**		6.34 [0.28]	
Regional dummies	70.6 [0.00]**	222 [0.01]*	84.3 [0.00]**	155 [0.15]
Log Likelihood	-930.9	-630.3	-810.3	-441.1
Observations	1107	833	857	541

Note: Dependent Variable: Working time on farm {Full, Half, No time}. Absolute values of z-statistics are in parentheses. P-values are in brackets. * indicates significant at 5% level; ** indicates significant at 1% level. Other variables included are the value of chicken, a dummy for livestock households, rainfall shocks in 1994 and 1995, and road dummies.

Table 5. Reduced Form Farm Labor Supply for Female Adults (Ordered Logit)

	Female Adults over 15 years-old	
		Wereda FE
	(1)	(2)
Individual Characteristics		
Age 15-25, splined	0.045	0.052
	(4.30)**	(4.49)**
Age 26 -	-0.028	-0.034
	(8.80)**	(9.62)**
Child Composition		
Boys 0-6 (#)	-0.023	0.006
	(0.60)	(0.13)
Girls 0-6 (#)	-0.003	0.010
	(0.06)	(0.22)
Boys 7-10 (#)	-0.005	0.037
	(0.10)	(0.70)
Girls 7-10 (#)	0.081	0.064
	(1.64)	(1.14)
Boys 11-14 (#)	0.036	0.070
	(0.70)	(1.20)
Girls 11-14 (#)	0.067	0.139
	(1.21)	(2.23)*
Other Demographic Composition		
Male adults (#)	-0.123	-0.153
	(3.72)**	(4.04)**
Female adults (#)	-0.038	-0.026
	(1.01)	(0.60)
Elders, male>=50 (#)	-0.006	-0.023
	(0.08)	(0.28)
Elders, female>=50 (#)	-0.152	-0.316
	(2.09)*	(3.74)**
Household Characteristics		
Household head's education (0,1)	-0.124	-0.139
	(1.84)	(1.80)
Female headed household (0,1)	0.456	0.644
	(4.55)**	(5.57)**
Female headed, but	0.870	0.900

married (0,1)		
	(6.70)**	(6.00)**
Land owned (ha)	-0.018	-0.014
	(2.55)*	(1.87)
Value of big animals ('000birr)	0.031	0.045
	(1.00)	(1.24)
Muslim (0,1)	-0.160	-0.140
	(1.79)	(1.02)
Protest (0,1)	0.037	0.045
	(0.38)	(0.36)
Regional Characteristics		
Distance to Primary School (km)	0.025	
	(2.97)**	
Average Rainfall (mm)	0.000	
	(1.04)	
Elevation	0.000	
	(2.45)*	
Observed % (Full, Half, No Time)	34, 39, 27	0.34, 0.39, 0.28
Wald tests: Demographic (7-14)	5.14 [0.27]	8.64 [0.07]
Demographic composition	21.8 [0.00]**	35.2 [0.00]**
Road dummies	50.5 [0.00]**	
Regional dummies	520 [0.00]**	1616 [0.00]**
Log Likelihood	-4985	-4266
Observations	5281	5253

Note: Dependent Variable: Working time on farm {Full, Half, No time}. Absolute values of z-statistics are in parentheses. P-values are in brackets. * indicates significant at 5% level; ** indicates significant at 1% level. Other variables included are the value of chicken, a dummy for livestock households, rainfall shocks in 1994 and 1995, and road dummies.

Table 6. Child Farm Labor Supply with Household Fixed Effects (Boys vs. Girls)

	Reduced Form		Conditional Farm Labor Supply	
	Logits [A]	Conditional Logits	Logits	Conditional Logits
	(1)	(2)	(3)	(4)
Food Aid				
Per capita Value from FD			4.0*10e-4	
			(0.02)	
Per capita Value from FFW			0.042	
			(1.77)	
*Food Aid * d (1 for girls)*				
Per capita Value from FD * d			0.039	0.024
			(2.17)*	(1.46)
Per capita Value from FFW * d			-0.048	-0.063
			(2.22)*	(2.38)*
Individual Characteristics				
Dummy: d (1 for girls)	-4.542	-3.348	-4.575	-3.510
	(1.61)	(1.14)	(1.61)	(1.18)
Age (7-10)	0.929	0.612	0.927	0.622
	(5.30)**	(3.15)**	(5.24)**	(3.11)**
Age (10-14)	0.339	0.243	0.356	0.242
	(2.14)*	(1.26)	(2.22)*	(1.23)
Age (7-10) * d	0.421	0.257	0.417	0.257
	(1.44)	(0.90)	(1.42)	(0.89)
Age (10-14) * d	-0.349	-0.138	-0.354	-0.097
	(1.73)	(0.64)	(1.74)	(0.45)
Step child	0.190	-0.387	0.232	-0.446
	(0.49)	(0.53)	(0.59)	(0.60)
Child, relative	-0.390	-0.836	-0.352	-0.861
	(0.95)	(1.51)	(0.85)	(1.53)
Child Composition				
Number of younger boys (7-14)	0.927	1.975	0.949	1.843
	(3.10)**	(2.14)*	(3.17)**	(1.97)*
Number of younger girls (7-14)	1.307	1.424	1.407	1.328
	(4.22)**	(1.63)	(4.46)**	(1.46)
Number of older boys (7-14)	-1.268	0.487	-1.283	0.313

	(4.63)**	(0.60)	(4.65)**	(0.38)
Number of older girls (7-14)	-0.283	-0.390	-0.230	-0.416
	(1.01)	(0.48)	(0.82)	(0.49)
*Child Composition * d (1 for girls)*				
Number of younger boys (7-14) * d	-0.664	-1.032	-0.643	-0.916
	(1.76)	(2.20)*	(1.69)	(1.94)
Number of younger girls (7-14) * d	-0.471	-0.387	-0.581	-0.518
	(1.26)	(0.96)	(1.52)	(1.25)
Number of older boys (7-14) * d	0.028	0.153	0.038	0.188
	(0.07)	(0.40)	(0.10)	(0.48)
Number of older girls (7-14) * d	-0.188	0.470	-0.250	0.373
	(0.48)	(1.04)	(0.63)	(0.81)
*Demographic Composition * d (1 for girls)*				
Boys 0-6 (#) * d	-0.077	-0.078	-0.089	-0.047
	(0.32)	(0.33)	(0.37)	(0.19)
Girls 0-6 (#) * d	-0.193	-0.355	-0.151	-0.339
	(0.76)	(1.40)	(0.59)	(1.33)
Male adults (#) * d	-0.235	-0.332	-0.242	-0.304
	(1.11)	(1.53)	(1.14)	(1.41)
Female adults (#) * d	0.520	0.308	0.567	0.372
	(1.92)	(1.08)	(2.08)*	(1.29)
Elders, male>=50 (#) * d	-0.978	-0.753	-1.110	-0.851
	(2.20)*	(1.73)	(2.47)*	(1.91)
Elders, female>=50 (#) * d	-0.081	-0.016	0.009	0.064
	(0.15)	(0.03)	(0.02)	(0.13)

Table 6. Continued.

	(1)	(2)	(3)	(4)
*Household Char. * d (1 for girls)*				
Household head's education (0,1)	0.019	0.005	0.019	-0.146
	(0.04)	(0.01)	(0.04)	(0.33)
Female headed household (0,1)	-0.260	-0.648	-0.260	-0.916
	(0.35)	(0.92)	(0.35)	(1.28)
Female headed, but married (0,1)	0.451	-0.185	0.451	-0.397
	(0.50)	(0.22)	(0.50)	(0.46)
Land owned (ha)	0.012	0.064	0.012	0.046
	(0.11)	(0.66)	(0.11)	(0.47)
Value of big animals ('000birr)	0.024	-0.009	0.024	0.008
	(0.33)	(0.12)	(0.33)	(0.12)
Muslim (0,1) * d	-1.265	-1.088	-1.265	-0.949
	(2.99)**	(2.48)*	(2.99)**	(2.15)*
Protest (0,1) * d	-1.589	-1.214	-1.589	-1.148
	(2.65)**	(2.23)*	(2.65)**	(2.07)*
Wald test: Food Aid * d				7.76 [0.02]*
Child Composition	42.6 [0.00]**	13.6 [0.01]**	44.7 [0.00]**	12.9 [0.01]*
Child Composition * d	3.62 [0.46]	5.60 [0.23]	3.97 [0.41]	4.73 [0.32]
Demographics * d	9.44 [0.15]	6.96 [0.32]	10.9 [0.09]	7.41 [0.28]
Household char. * d	4.85 [0.56]	3.88 [0.69]	6.79 [0.34]	5.96 [0.43]
Log Likelihood	-508.6	-195.8	-503.9	-191.5
Number of individuals	1561	1561	1561	1561
(Households)	577	577	577	577

Note: Absolute value of z-statistics are in parentheses. P-values are in brackets. * indicates significant at 5% level; ** indicates significant at 1% level. A) Logits also include demographic, household characteristics variables, and wereda dummies.

Table 7. Differential Effects Between Children and Female Adults

	Boys vs. Female Adults		Girls vs. Female Adults	
	Logits	Conditional logits	Logits	Conditional logits
	(1)	(2)	(3)	(4)
Food Aid				
Per capita Value of FD	-0.003		0.016	
	(0.56)		(1.44)	
Per capita Value of FFW	0.020		0.004	
	(2.52)*		(0.40)	
*Food Aid * d (female adult=1)*				
Per capita Value of FD * d	0.017	0.009	-0.018	-0.017
	(1.98)*	(1.45)	(1.53)	(1.94)
Per capita Value of FFW * d	-0.023	-0.015	-0.014	-0.010
	(2.68)**	(2.02)*	(1.25)	(1.12)
Individual Characteristics				
Dummy (d)[3] 1 for female adult	-3.115	-2.452	0.731	-0.210
	(5.33)**	(4.68)**	(1.19)	(0.36)
Age (7-10)	1.033	0.813	0.920	0.708
	(11.06)**	(9.47)**	(8.01)**	(6.67)**
Age (10-14)	0.668	0.518	0.471	0.363
	(7.57)**	(6.40)**	(5.32)**	(4.31)**
Age (15-25)	0.067	0.036	0.086	0.033
	(2.69)**	(1.45)	(2.96)**	(1.20)
Age (25-50)	-0.015	-0.001	-0.019	-0.001
	(1.39)	(0.11)	(1.48)	(0.09)
Age (50-)	-0.120	-0.097	-0.135	-0.105
	(6.93)**	(6.10)**	(7.05)**	(5.96)**
*Demog. Composition * d (f. adult=1)*				
Boys 0-6 (#) * d	-0.034	-0.020	0.111	0.083
	(0.25)	(0.16)	(0.72)	(0.58)
Girls 0-6 (#) * d	-0.144	-0.118	-0.049	0.001
	(1.04)	(0.98)	(0.30)	(0.01)
Boys 7-10 (#) * d	-0.173	-0.210	0.101	0.079
	(1.03)	(1.32)	(0.46)	(0.39)
Girls 7-10 (#) * d	-0.110	-0.138	-0.512	-0.266
	(0.60)	(0.84)	(2.58)**	(1.40)
Boys 11-14 (#) * d	0.340	0.439	0.513	0.354
	(1.94)	(2.64)**	(2.46)*	(1.85)
Girls 11-14 (#) * d	0.526	0.404	0.241	0.469

	(2.70)**	(2.26)*	(1.12)	(2.22)*
Male adults (#) * d	-0.012	-0.023	-0.109	-0.053
	(0.10)	(0.21)	(0.87)	(0.45)
Female adults (#) * d	-0.060	-0.063	-0.551	-0.251
	(0.44)	(0.50)	(3.71)**	(1.76)
Elders, male>=50 (#) * d	-0.719	-0.605	-0.490	-0.384
	(2.88)**	(2.66)**	(1.72)	(1.49)
Elders, female>=50 (#) * d	-0.715	-0.472	-0.841	-0.519
	(2.70)**	(1.94)	(3.20)**	(2.12)*
*Household Char. * d (female adult=1)*				
Household head's education (0,1) * d	0.788	0.598	0.665	0.538
	(3.26)**	(2.81)**	(2.23)*	(1.95)
Female headed household (0,1) * d	1.613	1.181	1.066	1.196
	(3.97)**	(3.28)**	(2.41)*	(2.85)**
Female headed, but married (0,1) * d	1.742	1.354	0.903	1.402
	(3.77)**	(3.14)**	(1.57)	(2.04)*
Land owned (ha) * d	0.080	0.077	-0.002	-0.010
	(1.20)	(1.28)	(0.06)	(0.32)
Value of big animals ('000birr) * d	0.000	-0.005	0.011	-0.004
	(0.00)	(0.13)	(0.21)	(0.08)
Muslim (0,1) * d	-1.589	-1.225	-0.772	-0.584
	(7.13)**	(6.11)**	(2.98)**	(2.47)*
Protest (0,1) * d	-0.681	-0.621	-0.357	-0.152
	(2.22)*	(2.25)*	(0.92)	(0.41)
Wald test: Food Aid * d	10.1 [0.01]**	5.69 [0.06]	4.82 [0.09]	5.80 [0.06]
Child Composition * d	11.6 [0.02]*	13.9 [0.01]**	13.9 [0.01]**	10.8 [0.03]*
Demographics * d	19.4 [0.00]**	13.5 [0.04]*	28.1 [0.00]**	10.9 [0.09]
Household char. * d	37.6 [0.00]**	28.2 [0.00]**	9.60 [0.14]	12.0 [0.06]
Log Likelihood	-1389	-707.4	-1091	-551.8
Number of individuals	2638 (875)	2638 (875)	2269 (789)	2269 (789)

Note: Absolute value of z-statistics are in parentheses. P-values are in brackets. * indicates significant at 5% level; ** indicates significant at 1% level. A) Logits also include demographic, household characteristics variables, and wereda dummies.